

Analysis of interplanetary flux ropes with an internal shock

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Geometries of interplanetary magnetic flux ropes (IFRs) are generally determined by model-fitting methods. There are many cases where an IFR includes an internal shock. In such cases, any simple model-fitting analysis cannot be used. In this study, we attempt to retrieve the original solar wind parameters by eliminating the shock effects. We first determine the shock normal of the internal shock, and calculate the unshocked parameters by using the shock-jump conditions. Once the above preparations are finished, the IFR geometries can be obtained by ordinary fitting methods. The present analysis method is based on two important assumptions: (1) the shock normal is maintained during propagation, and (2) changes in physical quantities by the passage of the shock are also maintained. Here we perform the above analysis for some selected IFR examples. It is seen that the above analysis method is successful and that the two assumptions are acceptable. The method significantly improve the applicability of the existing model-fitting methods.

Keywords: interplanetary magnetic flux rope, internal shock wave, model-fitting analysis